Independent Verification & Validation Program	Quality Manual	IVV QM Revision: M Effective Date: August 31, 2010

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APPROVAL SIGNATURES		DATE
Gregory Blaney (original signature on file)	Acting NASA IV&V Director	08/31/2010

REVISION HISTORY			
Revision	Description of Change	Author	Effective Date
Basic	Initial release to replace Ames QM	Siamak Yassini IT/332	09/09/1999
A – C	Revision information older than 7-year retention period relocated to Revision History Overflow Document	Various	05/07/2001 – 03/27/2003
D	Updated process coverage chart and document references.	Greg Blaney 307/387	09/24/2003
E	Updated organizational charts to reflect IV&V's new "Code 100" attachment to Goddard Space Flight Center.	Greg Blaney 180	03/11/2004
F	Updated sections 12.1 and 12.4 (verbiage update), references to NPG to be NPR, and a ref. in sec. 9.1 to 09-4.	Greg Blaney 180	05/25/2004
G	Updated to include three pillars in the quality process and incorporate new procedures into the IMS	Greg Blaney 180	10/20/2005
H	Annual review updates	Greg Blaney	01/24/2006
I	Updated content; moved appendix material to separate documents	Stephanie Ferguson	10/10/2007
J	Updated Vision, Quality Policy, and document references; updated terms and definitions resulting from re-engineering process	Stephanie Ferguson	04/08/2008
K	Updated terminology to reflect the current organizational structure and to meet the ISO 9001:2008 Standard	Stephanie Ferguson	07/14/2009

L	Updated to reflect new organizational structure	Stephanie Ferguson	07/13/2010
M	Revised information on PEP; added execution plan process diagram	Greg Blaney	08/31/2010

REFERENCE DOCUMENTS	
Document	Title
IVV all	All IMS Documents
NPD 1000.3	The NASA Organization
NPD 1280.1	NASA Management System Policy
NPR 1441.1	NASA Records Retention Schedules
ISO 9001:2008	International Organization for Standardization: Quality Management Systems Requirements
http://acquisition.gov/comp/far/index.html	Federal Acquisition Regulation (FAR)
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm	NASA FAR Supplement (NFS)

If any process in this document conflicts with any document in NODIS, this document shall be superseded by the NODIS document. Any reference document external to NODIS shall be monitored by the Process Owner for current versioning.

Table of Contents

1.0 Purpose

This document defines the manner in which the NASA IV&V Program implements the NASA IV&V Management System (IMS). The IMS establishes process guidelines through system level procedures (SLPs), work instructions (WIs), templates, supporting documents, and forms to ensure that customers receive the highest quality products and services.

1.1 Vision and Mission Statements

1.1.1 Vision

The NASA IV&V Program provides confidence and integrity in software that cannot be found elsewhere.

1.1.2 Mission

The NASA IV&V Program will reduce the inherent risk in the Agency's ability to procure, develop, deploy and operate software within desired cost, schedule and performance goals

- Perform IV&V on safety and mission critical software
- Provide software expertise to the Agency's SMA activities
- Conduct research that improves IV&V and software assurance methods, practices and tools
- Perform Science, Technology, Engineering, and Mathematics (STEM) outreach
- Perform management and institutional services with excellence

1.2 Quality Policy

The Quality Policy of the NASA IV&V Program is

"To provide superior quality products and services, through continuous improvement, that meet or exceed customer requirements."

The NASA IV&V Quality Policy applies to the IMS as well as the management and organizational processes employed to achieve the NASA IV&V Program's quality objectives.

1.2.1 IMS

Quality objectives can only be achieved by operating a comprehensive, coordinated quality management system that ensures the quality of all products, processes, and services offered by the NASA IV&V Program. This quality management system is the IMS. The IMS is designed to meet the requirements of the International Organization for Standardization (ISO) 9001:2008 Standard, and it shall be implemented across the NASA IV&V organization.

The IMS contains SLPs, WIs, templates, supporting documents, and forms that have been developed to standardize the planning, performance, control, and measurement of NASA IV&V work. A number of the SLPs and WIs have been designed to facilitate a system for monitoring and improving all processes and procedures contained in the IMS.

The IMS shall encompass all of the activities that affect the products and services that the NASA IV&V Program provides to customers.

The NASA IV&V Program practices continuous improvement in its consistent refinement and enhancement of IMS processes. Assurance that the IMS is current and comprehensive allows the NASA IV&V Program to ensure that its employees are trained, that its performance is at the leading edge, and that its functional organizations are able to regularly provide input on how to keep processes at the forefront of IV&V demands.

The IMS Documentation Master List on the IMS web site (http://ims.ivv.nasa.gov) provides a current representation of all IMS documents, Process Owners (POs), and revision information.

1.2.2 Management

The NASA IV&V Director, Senior Leadership, and employees ensure that the IMS is effective at achieving quality of products and services and exceeding customer requirements.

Program Management (i.e., the NASA IV&V Director, Deputy Director, and Associate Director) shall ensure that quality objectives are established, measured, reported, and incorporated into the NASA IV&V Metrics Table.

Each quarter, Metric Owners shall collect and analyze their metrics and report their analysis to Program Management at the Quarterly Management Review (QMR). Noncompliant metrics will be evaluated by Program Management, documented in the QMR minutes, and handled with action items as needed.

It is through the QMR and other such reviews that the NASA IV&V Program is able to continuously improve products, processes, and quality management methods that demonstrate the suitability, adequacy and effectiveness of the IMS. Customer feedback is another method of measuring the NASA IV&V Program's success at tracking to its metrics and attaining continuous improvement.

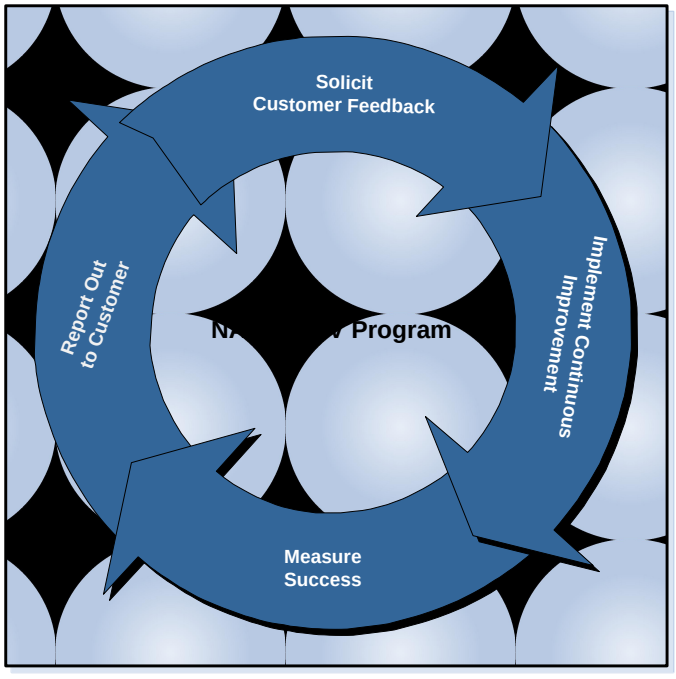

Figure 1 – NASA IV&V Process for Customer Feedback

This process of receiving input from and reporting out to customers allows the NASA IV&V Program to augment its continuous improvement efforts.

1.2.3 Organization

Investing in personnel and emphasizing training are testaments to the NASA IV&V Program's commitment to quality. Because the development of skilled personnel contributes to the production of high-quality products and services, the NASA IV&V Program shall regularly recognize and reward effective teamwork and individual achievements.

1.3 Quality Objectives

The NASA IV&V Program's quality objectives aim to consistently provide quality products and services to NASA IV&V customers in addition to addressing customer requirements. These IMS-supported quality objectives are identified in the Program Execution Plan (PEP) and Office Execution Plans (OEPs). These documents are designed to outline the planned work, schedule, and resources required to accomplish the NASA IV&V Program's objectives for a given fiscal year (FY). These documents establish an integrated management mechanism that defines:

- Expected outcomes of the NASA IV&V Program
- Processes to accomplish the expectations
- Clear roles and responsibilities/expectations
- Clear communication paths

The PEP institutes the mechanisms that the NASA IV&V Director deems necessary for upholding the goal of continuous improvement put forth in the NASA IV&V Program's Quality Policy. In conjunction with the PEP, each NASA IV&V core functional area, or office, compiles an OEP to document how that office and its affiliated groups will conduct business during the FY in order to support the achievement of the objectives instituted by NASA Headquarters (HQ)/Goddard Space Flight Center (GSFC). The PEP assists the NASA IV&V Director and Senior Leadership in formulating program-level budget decisions based on the technical and financial information provided by each OEP.

The PEP and OEPs will be developed and executed in accordance with the process demonstrated in the following diagram.

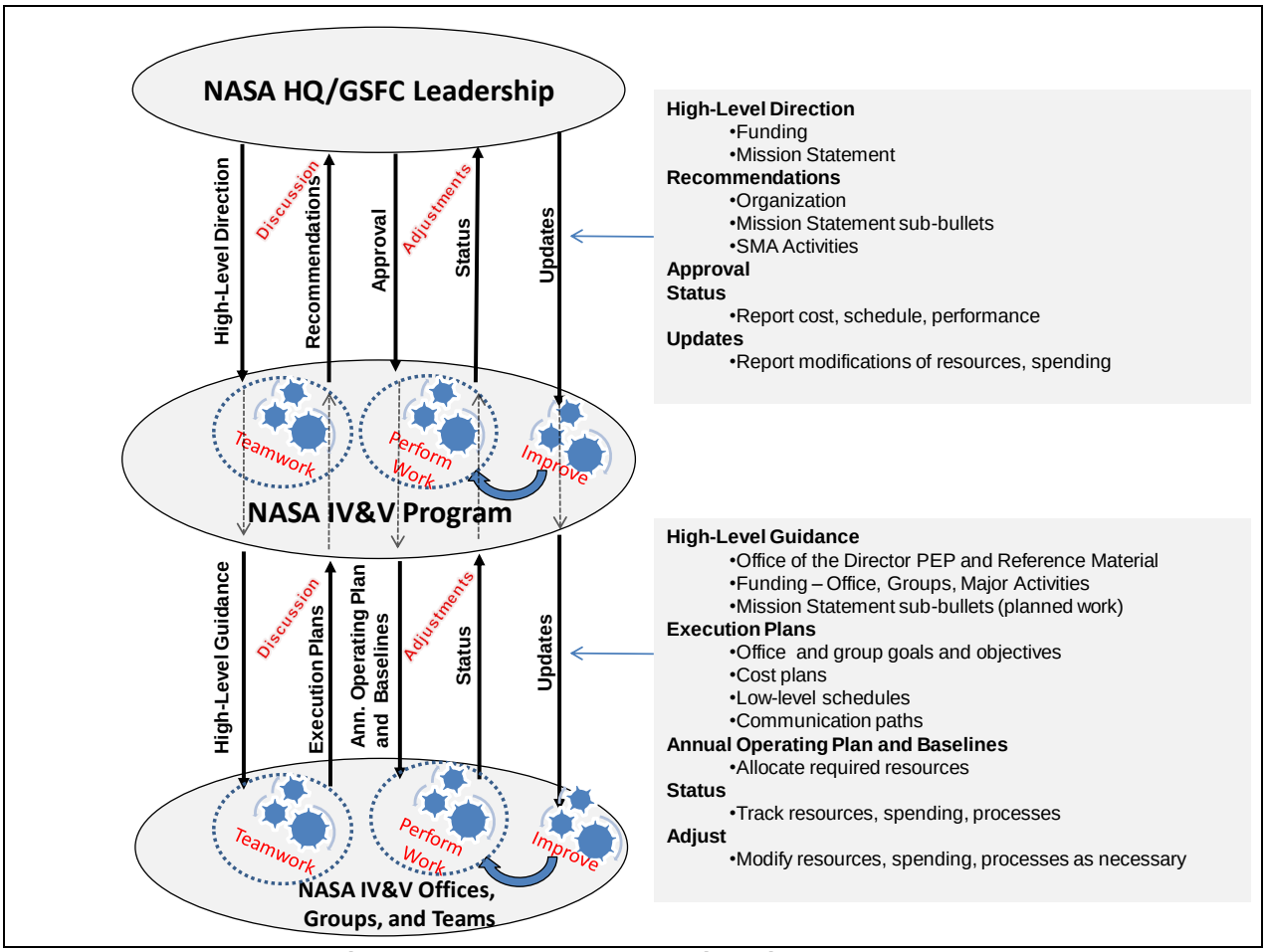

Figure 2 – NASA IV&V Execution Plan Process

Checks and balances among the NASA IV&V Program, NASA HQ/GSFC, and NASA IV&V Offices ensure that the Program as a whole receives the high-level direction it needs to carry out its PEP objectives, while also ensuring that the Offices receive the high-level guidance necessary for supporting and performing to the plans and baselines outlined in their OEPs. More information on OEPs can be found in IVV 01, *Execution Plan Procedure.*[1]

[1] IVV 01, *Execution Plan Procedure*, was being drafted for initial release at the time of this publication.

2.0 Scope

This document applies to the work performed under the scope of the NASA IV&V Program's ISO certification:

- Independent Software Verification and Validation
- System Software Independent Assessments
- Systems and Software Engineering Research
- Software Support for the Office of Safety and Mission Assurance (OSMA)

This scope encompasses all of the work activities performed by the NASA IV&V Program and documented in the IMS. The IMS is the core of the NASA IV&V Program's effort to uphold its vision and mission statements, and accomplishment of this goal relies on the NASA IV&V Program's successful execution in its core functional areas.

Understanding the key elements of the NASA IV&V Program's mission allows employees to advance that mission across several primary areas of focus, known as functional organizations. Individually and collectively, these functional organizations generate the methods for meeting the objectives outlined in the PEP.

Each functional organization is headed by an Office Lead (also known as Functional Lead), whose responsibility is to provide oversight for his/her functional organization and its work performance in order to facilitate the achievement of the goals and objectives of the functional organization as well as the overall NASA IV&V Program.

The following chart depicts the organizational structure for the NASA IV&V Program. In the chart, each functional organization is constituted by a core office (in the highlighted row) plus its respective groups.

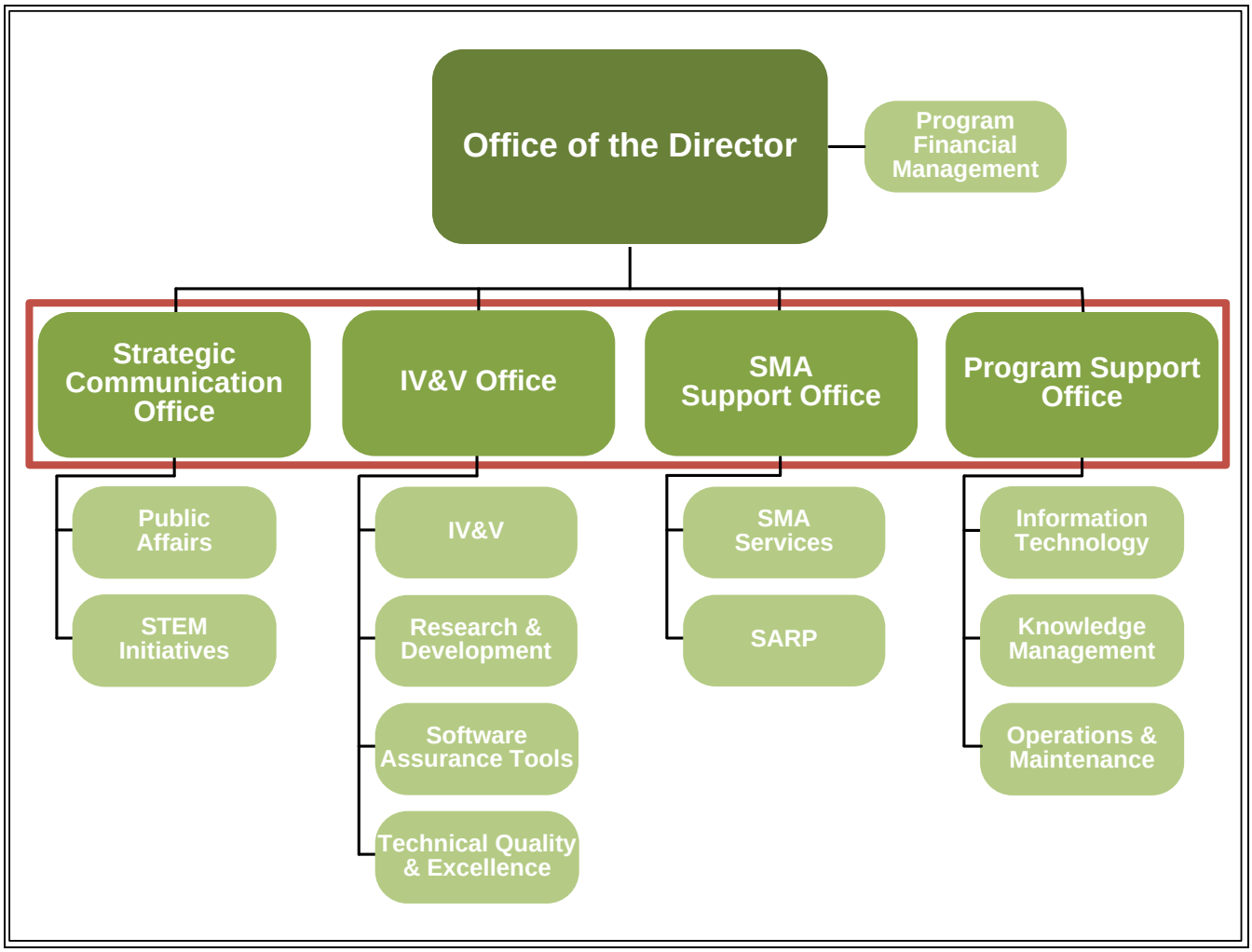

Figure 3 – NASA IV&V Program Organization

2.1 Office of the Director

The purpose of the Office of the Director is to provide overall management of the NASA IV&V Program and NASA IV&V Facility. The Office of the Director comprises the Director, Deputy Director, Associate Director, Program Financial Management (PFM) Lead, and other administrative

staff to support the office's various functions. These functions include customer relations, the Technical Advisory Board, IT governance, program execution planning, new business, financial management, legislative affairs; and the functions also include all procurement/contract, human resources, EEO/diversity, and legal interfaces with GSFC.

The Office of the Director also includes the PFM Group. The PFM Group is responsible for ensuring the overall integrity of the financial dollars for the NASA IV&V Program and for implementing financial controls through various systems.

2.2 Strategic Communication Office

The Strategic Communication Office strives to facilitate internal and external communications and common understanding across the NASA IV&V Program, as well as engage the Program in the vitality of the communities that host and surround it. The objectives of the Strategic Communication Office are supported by the efforts of the Public Affairs Group, as well as the Science, Technology, Engineering, and Math (STEM) Initiatives Group.

The purpose of the Public Affairs Group is to communicate information regarding the NASA IV&V Program to external entities, including the public, the news media, and other customers. The Public Affairs Group ensures that all NASA IV&V external communications, web contents, and publications are accurate, appropriate, and in compliance with Agency review requirements, rules, and regulations.

The primary purpose of the STEM Initiatives Group is to engage the public in the experience and benefit of exploration and discovery. This group manages all NASA IV&V activities that support the Agency's commitment to take STEM education to the public through students, educators, and universities. These activities include student outreach, education, and community relations.

2.3 IV&V Office

The purpose of the IV&V Office is to perform independent verification and validation on NASA mission-critical software, providing assurance that the software will operate dependably and safely. The IV&V Office includes

four groups that specialize in the following areas: IV&V, Research and Development (R&D), Technical Quality and Excellence (TQ&E), and Software Assurance Tools (SWAT).

The IV&V Group is responsible for producing evidence-based mission assurance through the execution of IV&V and Independent Assessment activities on NASA-selected or customer-funded projects.

The R&D Group advances IV&V processes, tools, and knowledge through the exploration and integration of practical solutions.

The TQ&E Group ensures that excellent IV&V products and services result from consistent and acceptable adherence to expectations, procedures, and processes across the IV&V Office. This effort also ensures that IV&V procedures and processes are effective and efficient.

The SWAT Group is responsible for the Computer Aided Software Engineering (CASE) tools needed to support the IV&V Office. This group is also responsible for assisting with the integration of IV&V tools advanced through R&D, as well as maintaining the tools, and providing knowledge and assistance in the use of the tools and solutions.

2.4 Safety and Mission Assurance (SMA) Support Office

The purpose of the SMA Support Office is to manage software engineering services provided to the Agency in support of other OSMA organizations. This office includes the SMA Services Group and the delegated Software Assurance Research Program (SARP).

The SMA Support Office primarily focuses on supporting various NASA Center SMA organizations to provide on-demand software assurance support. Specific safety-related or mission assurance tasks are identified and coordinated with the Chief of the OSMA.

The SMA Services Group primarily performs short-term focused tasks and provides trained staff to assist NASA Center SMA personnel in accomplishing their SMA objectives, particularly where focused knowledge such as software analysis is required.

Additionally, the SMA Support Office hosts the SARP on behalf of the NASA IV&V Program. Although it is housed by the NASA IV&V Program, the SARP operates as a function of the OSMA. The program was conceived to identify, develop, adopt, and integrate software assurance and engineering best practices into NASA missions and programs. The program focuses on applied research that has the potential to support more informed decision making, improve safety and reliability, and reduce mission cost.

2.5 Program Support Office

The Program Support Office provides resources to all functional organizations across the NASA IV&V Program. The Program Support Office comprises the Operations and Maintenance (O&M), Information Technology (IT), and Knowledge Management groups.

The O&M Group's primary responsibility is to provide and ensure a safe, comfortable, and well-equipped workplace that is conducive to high performance and is supportive of individual and team productivity.

The IT Group is responsible for providing desktop technology, maintaining the backbone connection between devices and other centers, providing a common communications framework for data and voice, ensuring dissemination of information on the internet, securing all IT resources, and hosting NASA IV&V tools.

The Knowledge Management Group is responsible for coordinating and tracking civil service employee training, execution plans, customer surveys, risk management, lessons learned, success stories, metrics, records, IMS, and Statement of Assurance activities that support the NASA IV&V Program.

3.0 Organization

The NASA IV&V Program is a NASA Program established in accordance with NPD 1000.3, *The NASA Organization*.[2] The NASA IV&V Program functions operationally under the guidance of the Chief of the OSMA while receiving administrative support from GSFC. The NASA IV&V Director is a NASA HQ employee who serves as the NASA IV&V Program Manager and reports directly to the Chief of the OSMA.

The IV&V Board of Advisors (IBA) is a NASA-level board chaired by the Chief of the OSMA. It is comprised of advisors representing each Mission Directorate Associate Administrator (AA), the Chief Information Officer (CIO), the Chief Engineer, the GSFC Director, and the NASA IV&V Program. The IBA's purpose is to advise the Chief of the OSMA on the funding requirement and allocation of IV&V services among NASA's programs and projects on an annual basis.

The following organizational charts depict the NASA IV&V Program's relationship with GSFC within Code 100, as well as the NASA IV&V Program's relationship with the OSMA.

[2] Note: At the time of QM publication, NPD 1000.3 did not yet reflect the most current NASA IV&V organization.

3.1 GSFC Code 100

The following chart depicts how the NASA IV&V Program is linked to GSFC Code 100.

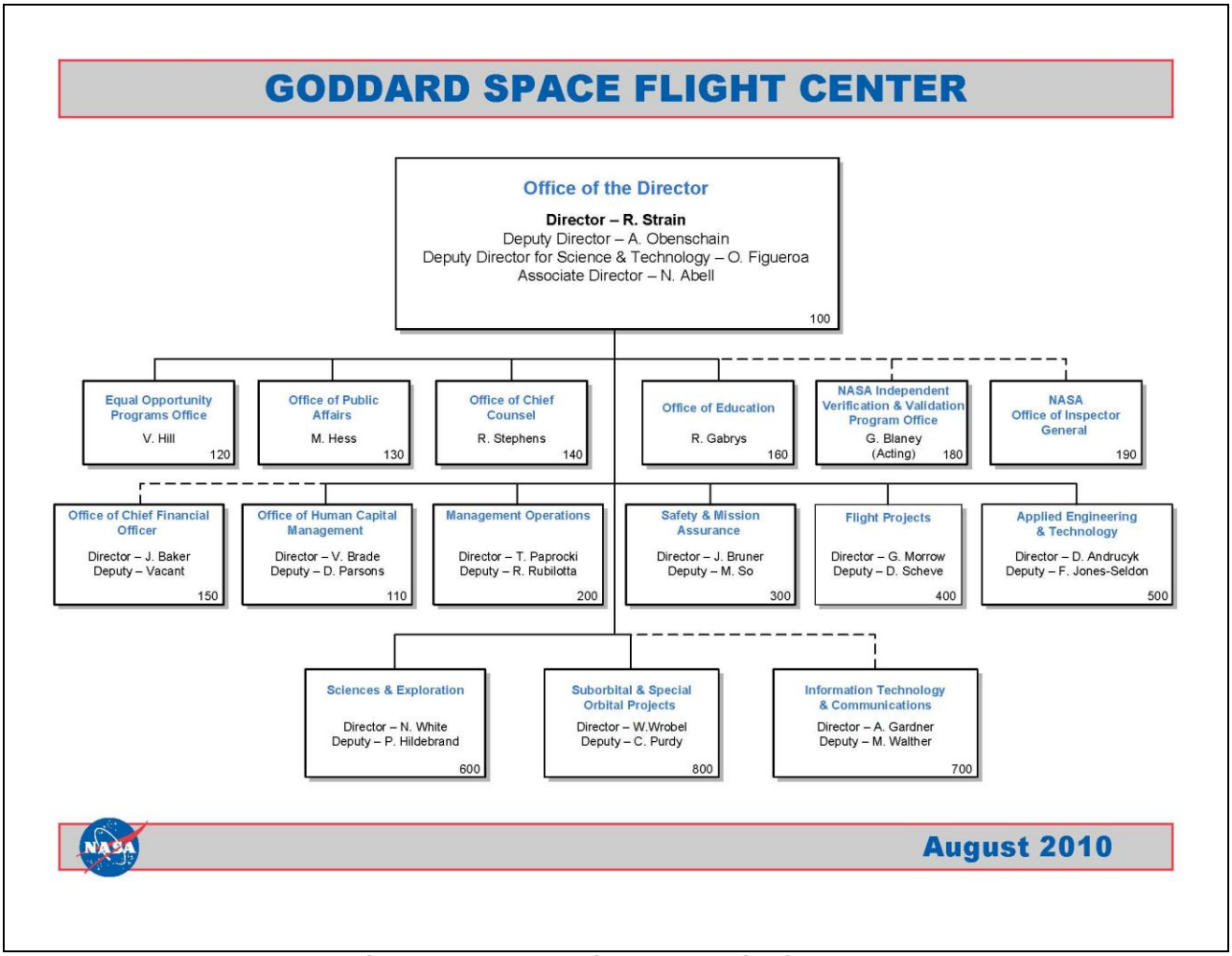

Figure 4 – GSFC Code 100 Organization

Please refer to the GSFC Organizations webpage for the most current representation of Code 100.

3.2 OSMA

The following chart depicts how the NASA IV&V Program is linked to the OSMA.

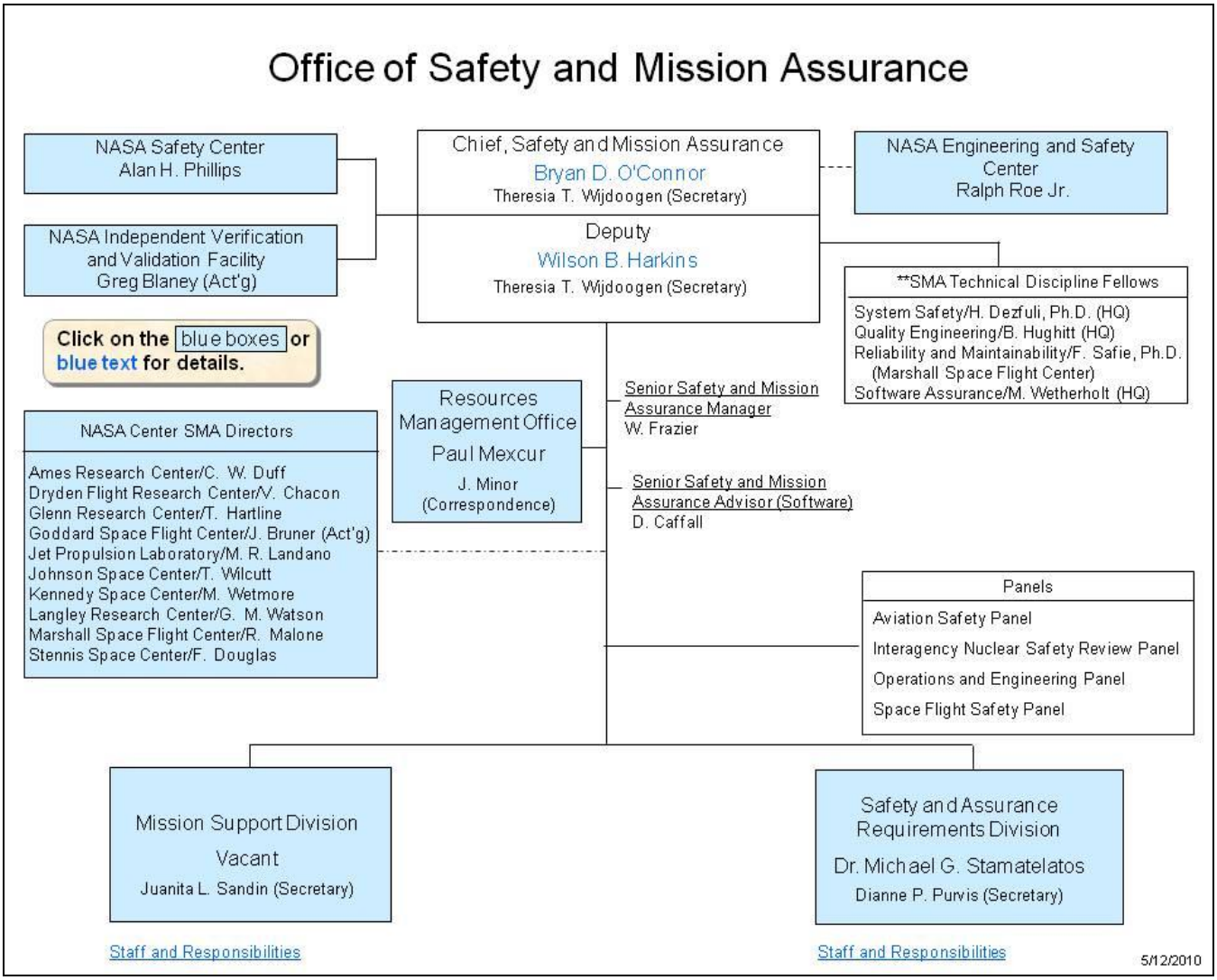

Figure 5 – OSMA Organization

Please refer to the OSMA Organization webpage for the most current representation of the OSMA.

4.0 IMS Document Application

This section describes the IMS documents as they support work performed by all NASA IV&V functional organizations. To ensure continuous improvement, every IMS document is reviewed on an annual basis for currency, accuracy, and applicability to the NASA IV&V Program.

The ISO 9001:2008 Standard mandates that all quality management systems shall address six required areas:

- Control of Documents
- Control of Records
- Internal Audits
- Control of Nonconforming Product
- Corrective Action
- Preventive Action

These six areas required by the ISO 9001:2008 Standard are addressed in Sections 4.4, *IV&V Office*, and 4.5.1, *IMS.*

For a graphical depiction of the ISO 9001:2008 Standard requirements applied to the IMS documents and functional organizations, see Appendix C – ISO Standard Requirement Mapping Diagram.

4.1 Office of the Director

The IMS includes processes that support the activities performed under the purview of the Office of the Director. These processes include:

- IVV QM, *Quality Manual*
- IVV 08, *Contracting Officer Technical Representative*
- IVV 11, *IT Business Management*
- IVV 25, *Legislative Affairs*

4.1.1 Program Financial Management

The IMS includes methods for ensuring that acquired products and services conform to specified requirements; initiating and processing a Purchase Request (PR); processing procurements for grants and cooperative agreements; receiving, distributing,

tracking, and reporting funding and financial activities; and requesting Director's Discretionary Funding (DDF).

The following IMS documents describe the processes performed to support NASA IV&V financial management:

- IVV 06, *Purchasing*
- IVV 06-1, *Work Instruction for Completing a Purchase Request*
- IVV 07, *Financial Data Control*

4.1.2 Resource Management

The IMS establishes methods for documenting the administrative activities performed out of the Office of the Director: requesting and managing supplies, and performing training and other functions related to human resource management.

The following IMS documents describe the processes performed to support NASA IV&V resource management:

- IVV 02, Administrative Controls
- IVV 18, Human Resource Management

4.2 Strategic Communication Office

The IMS establishes guidelines for defining and managing NASA IV&V Strategic Communication through a number of measures, including internal and external communications, media, and educational outreach programs.

The following IMS document describes the processes performed to support NASA IV&V communications:

- IVV 31, *STEM Initiatives*
- IVV 32, *Public Affairs*

4.3 SMA Support Office

The IMS establishes methods for providing technical software assurance support. SMA Support methods are currently under development for inclusion as formal IMS procedures.

4.3.1 SARP

The IMS establishes methods for SARP planning; proposal solicitation; evaluation and selection; and initiative contracting and management, which includes the management and publication of research results.

The following IMS documents describe the processes performed to support the SARP:

- IVV 09-7, *Research Program*
- IVV 09-7-1, *Work Instruction for Evaluating and Reviewing Research Initiatives*
- IVV 09-7-2, *Work Instruction for Selecting OSMA SARP Research Initiatives*
- IVV 09-7-3, *Work Instruction for Selecting IV&V Facility Research Initiatives*
- IVV 09-7-5, *Work Instruction for Processing Research Products*
- IVV 09-7-7, *Work Instruction for the Publication/Presentation of Research Results*

4.4 IV&V Office

The IMS establishes methods for planning IV&V technical services to customers and performing project management.

The following IMS documents describe the processes performed to support IV&V activities:

- IVV 09-1, *Independent Verification and Validation Technical Framework*
- IVV 09-4, *Project Management*
- IVV 20*, NASA IV&V Tools Lab Request Process*

IVV 09-4, *Project Management*, addresses "Control of Nonconforming Product," one of the six areas required by the ISO 9001:2008 Standard.

4.5 Program Support Office

Certain processes are shared across all functional organizations. The following IMS documents describe these shared processes:

- IVV 01, *Execution Plan Procedure*[3]
- IVV 04, *Operations and Maintenance Services Request Process*
- IVV 10, *Software and Hardware Configuration Management*
- IVV 12, *NASA IV&V Metrics*
- IVV 20-1, *World Wide Web Resource Review and Approval*
- IVV 22, *Risk Management*
- IVV 23, *Lessons Learned*
- IVV 24, *Success Stories*

4.5.1 IMS

The IMS includes processes for managing IMS-controlled documentation and data, implementing corrective and preventive action processes that track the identification and resolution of product and process nonconformities, managing quality records, and administering the NASA IV&V Internal Assessment Audit Program.

These IMS processes apply to all NASA IV&V functional organizations and address the majority of ISO 9001:2008 Standard requirements.

The following documents directly support IMS implementation and administration. These documents also address five of the six areas required by the ISO 9001:2008 Standard.

- IVV 05, *Document and Data Control*
  - Addresses the "Control of Documents" requirement
- IVV 13, *Waiver Process*

[3] IVV 01, *Execution Plan Procedure*, was being drafted for initial release at the time of this publication.

- IVV 14, *Corrective and Preventive Action*
  - Addresses the "Corrective Action" and "Preventive Action" requirements
- IVV 16, *Control of Records*
  - Addresses the "Control of Records" requirement
- IVV 17, *Internal Quality Audits*
  - Addresses the "Internal Audits" requirement

The following appendices contain content maintained in separate documents. Follow the links provided to view the documents.

Appendix A – Acronyms and Definitions
http://www.nasa.gov/centers/ivv/doc/192128main_IVV_QM_A.doc

Appendix B – Responsibilities and Authorities
http://www.nasa.gov/centers/ivv/doc/192130main_IVV_QM_B.doc

Appendix C – ISO Standard Requirement Mapping Diagram
http://www.nasa.gov/centers/ivv/doc/192132main_IVV_QM_C.doc